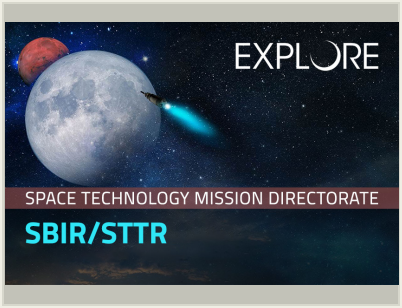
High Energy Density Li-Ion Batteries Designed for Low Temperature Applications, Phase II

Completed Technology Project (2011 - 2014)

Project Introduction

The state-of-the-art Li-ion batteries do not fully meet the energy density, power density and safety requirements specified by NASA for future exploration missions. Building upon our Phase I feasibility study, we propose to implement an advanced cathode material in practical Li-ion batteries. The cathode material offers superior electrochemical performance over its commercially used counterpart, particularly in terms of discharge capacity and energy density. In Phase I, working in collaboration with a leading university-based researcher, we demonstrated that intrinsic modifications in the crystal structure, and extrinsic modifications on the surface of cathode particles, can lead to energy densities greater than 1150 Wh/kg at room temperature and 800 Wh/kg at zero degrees C for the cathode powder. In the Phase II program, we intend to combine the intrinsic and extrinsic effects in the cathode material, which will deliver the needed energy density at low temperatures, along with other desirable attributes. This will represent a significant advancement of the state-of-the-art in cathode materials. The structural and morphological modifications introduced in the material will allow us to (i) maintain high energy and power density at low temperature (ii) lower the irreversible capacity loss and improve the efficiency, and (iii) further stabilize and enhance the safety of the cell. In Phase II, our university-based collaborator will fabricate and test small Li-ion pouch cells, which will help optimize the cathode material. In addition, prototype Li-ion cells with a capacity of ~ 5Ah will be fabricated and tested by a large Li-ion battery manufacturer and supplier to the aerospace industry. Further, a NASA prime contractor has offered to guide the Phase II program. The outcome of a successful Phase II program will be the demonstration of an advanced and robust energy storage system that can be used for future NASA applications.



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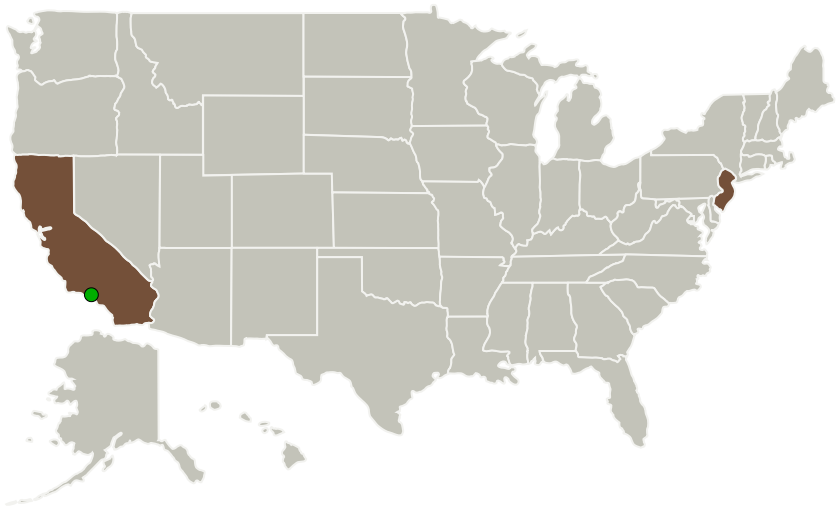
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
NEI Corporation	Lead Organization	Industry Small Disadvantaged Business (SDB)	Piscataway, New Jersey
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	New Jersey

Project Transitions

June 2011: Project Start

June 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138914)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

NEI Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Nader Hagh

Co-Investigator:

Nader Hagh

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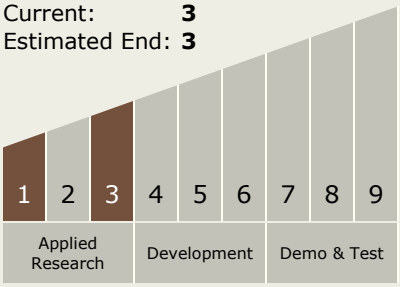
Completed Technology Project (2011 - 2014)

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.2 Energy Storage
    - TX03.2.1 Electrochemical: Batteries

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System